

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 23 May 2000 (23.05.00)	
International application No. PCT/GB99/03153	Applicant's or agent's file reference IK/20917
International filing date (day/month/year) 23 September 1999 (23.09.99)	Priority date (day/month/year) 23 September 1998 (23.09.98)
Applicant MASON, Andrew, James	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
19 April 2000 (19.04.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer <p style="text-align: center;">Juan Cruz</p> Telephone No.: (41-22) 338.83.38
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The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

EA/

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND	
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference IK/20917	
International application No. PCT/GB99/03153	International filing date (day/month/year) 23 SEPTEMBER 1999	(Earliest) Priority date (day/month/year) 23 SEPTEMBER 1998	
Title of invention AUDIO COMPRESSION			
Box No. II APPLICANT(S)			
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) BRITISH BROADCASTING CORPORATION Broadcasting House London W1A 1AA UNITED KINGDOM		Telephone No.:	
		Facsimile No.:	
		Teleprinter No.:	
State (that is, country) of nationality: GB		State (that is, country) of residence: GB	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) MASON, Andrew James 1 Meadow Way Reigate Surrey RH2 8DP UNITED KINGDOM			
State (that is, country) of nationality: GB		State (that is, country) of residence: GB	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) 			
State (that is, country) of nationality:		State (that is, country) of residence:	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.			

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*KAZI: ILYA
MATHYS & SQUIRE
100 Grays Inn Road
London WC1X 8AL
UNITED KINGDOM

Telephone No.:

020 7830 0000

Facsimile No.:

020 7830 0001

Teleprinter No.:

-

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☒ as originally filed☐ as amended under Article 34the claims ☒ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☒ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: ENGLISH☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary Examining Authority use only

received not received

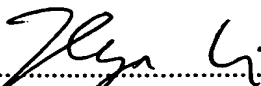
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).


KAZI: ILYA

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

International application No. PCT/GB99/03153	For International Preliminary Examining Authority use only	
Applicant's or agent's file reference IK/20917/E.6611	Date stamp of the IPEA	
Applicant BRITISH BROADCASTING CORPORATION		
Calculation of prescribed fees		
1. Preliminary examination fee	EUR 1,533.00	<input type="checkbox"/> P
2. Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i>	EUR 147.00	<input type="checkbox"/> H
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	EUR 1,680.00	
TOTAL		
Mode of Payment		
<input checked="" type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash	
<input type="checkbox"/> cheque	<input type="checkbox"/> revenue stamps	
<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons	
<input type="checkbox"/> bank draft	<input type="checkbox"/> other (specify):	
Deposit Account Authorization <i>(this mode of payment may not be available at all IPEAs)</i>		
The IPEA/ _____ <input checked="" type="checkbox"/> is hereby authorized to charge the total fees indicated above to my deposit account.		
<input type="checkbox"/> <i>(this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)</i> is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.		
2805.0049	19-4-00	
Deposit Account Number	Date (day/month/year)	Signature

TENT COOPERATION TREATY

PCT

INFORMATION CONCERNING ELECTED
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

From the INTERNATIONAL BUREAU

To:

KAZI, Ilya
Mathys & Squire
100 Gray's Inn Road
London WC1X 8AL
ROYAUME-UNI

Date of mailing (day/month/year) 23 May 2000 (23.05.00)		
Applicant's or agent's file reference IK/20917		IMPORTANT INFORMATION
International application No. PCT/GB99/03153	International filing date (day/month/year) 23 September 1999 (23.09.99)	Priority date (day/month/year) 23 September 1998 (23.09.98)
Applicant BRITISH BROADCASTING CORPORATION et al		

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE
National : AU, CA, JP, US

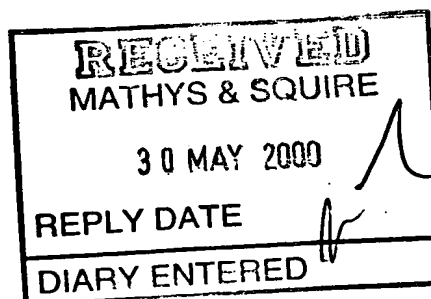
2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

None

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.



<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. (41-22) 740.14.35</p>	<p>Authorized officer: Juan Cruz</p> <p>Telephone No. (41-22) 338.83.38</p>
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PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

RECEIVED
MATHYS & SQUIRE

To:

15 NOV 1999

KAZI, IRE

Mathys & Squire

100 Gaysmith Road

London WC1X 8AL

ROYAUME-UNI

Date of mailing (day/month/year) 03 November 1999 (03.11.99)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference IK/20917	
International application No. PCT/GB99/03153	
International publication date (day/month/year) Not yet published	
International filing date (day/month/year) 23 September 1999 (23.09.99)	Priority date (day/month/year) 23 September 1998 (23.09.98)
Applicant BRITISH BROADCASTING CORPORATION et al	

- The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
- This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
- An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
- The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
23 Sept 1998 (23.09.98)	9820757.4	GB	29 Octo 1999 (29.10.99)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer Carlos Naranjo Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICE

(PCT Rule 47.1(c), first sentence)

To:

KAZI, Ilya
Mathys & Squire
100 Gray's Inn Road
London WC1A 1AA
ROYAUME-UNI

RECEIVED

10 APR 2000

REPLY DATE

DIARY ENTERED

Date of mailing (day/month/year) 30 March 2000 (30.03.00)		IMPORTANT NOTICE	
Applicant's or agent's file reference IK/20917			
International application No. PCT/GB99/03153	International filing date (day/month/year) 23 September 1999 (23.09.99)	Priority date (day/month/year) 23 September 1998 (23.09.98)	
Applicant BRITISH BROADCASTING CORPORATION et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU,JP,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
CA,EP

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
30 March 2000 (30.03.00) under No. WO 00/18046

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

Continuation of Form PCT/IB/308

**NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF
THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES**

Date of mailing (day/month/year) 30 March 2000 (30.03.00)	IMPORTANT NOTICE
Applicant's or agent's file reference IK/20917	International application No. PCT/GB99/03153
<p>The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.</p>	

Our Ref: IK/20917
Yr. Ref: -

European Patent Office
Directorate General 2
D-80298 Munich
Germany

VIA FACSIMILE

25 September 2000

Dear Sirs

International Patent Application No. PCT/GB99/03153
British Broadcasting Corporation

I refer to the Written Opinion dated 23rd June 2000.

Filed herewith in triplicate are replacement pages of claims.

We are surprised that the Examiner found the application to be so unclear that he was unable to perform any substantive examination whatsoever. It is believed that a skilled person familiar with the art having read the application would not have had such clarity problems. Nevertheless, to assist the Examiner we will briefly explain the invention and expand on the explanation presented on the first page of the introduction which discusses a document equivalent to D1, the applicant's own earlier application. The representative attempted to telephone the Examiner to discuss this case but the Examiner was apparently unavailable due to illness when the representative telephoned. If on reading the entire application and these comments the Examiner still has difficulties, he is requested to review the application with another member of his directorate. Should the Examiner still have difficulties with the claims, he is requested to telephone the representative in order that substantive progress can be made during the International Preliminary Examination procedure.

The various clarity objections raised are discussed below.

By way of general background, compression encoding schemes have been used for some time, such as MPEG II. Since the coding processes are not lossless, cascaded decoding and coding processes can introduce losses. The applicant has previously proposed carrying an auxiliary data signal with the main data signal to assist in recoding. However, if the signal is processed between stages, for

cont/...

FACSIMILE TRANSMISSION
[ORIGINAL FOLLOWING BY MAIL]

No. of pages: @
Fax No: 00 49 89 2399 4465

THIS MESSAGE IS CONFIDENTIAL AND MAY CONTAIN PRIVILEGED INFORMATION
INTENDED ONLY FOR THE USE OF THE ADDRESSEE

example in an effects processor or the like, the auxiliary signal will not necessarily be helpful. The applicant's earlier application proposes adding a CRC check to the audio data (as pointed out by the Examiner on page 4, lines 24-32) to detect non-transparent processing. This is particularly important since, in that earlier application, the auxiliary data is preferably carried with the audio and could be heavily corrupted by even a small change to the audio.

That earlier application works well for simple cascaded coding and recoding processes but offers no benefit when some processing is applied. In the present invention, a signature of the audio data itself is also supplied and this allows the audio data to be compared to the signature to determine a change. By including a signature of the audio data significant changes can be detected but minor changes which do not necessarily render the auxiliary data wholly useless can be tolerated. Thus, rather than simply disabling the assisted coding in the event of a small change, the provision of a signature signal allows more intelligent use of the data. This goes a step further than suggested by the applicant's earlier application and since this step is not suggested by any other prior art, an inventive step further.

Although, as noted above, we are surprised that the Examiner was unable to assess the application substantively due to lack of clarity but, in view of the explanation presented herein and amendments made in an effort to be as helpful as possible to the Examiner, it is hoped that a wholly favourable International Preliminary Examination Report can be issued. These amendments are made without prejudice or admission, purely to expedite the procedure.

Dealing with each of the objections in turn, we turn first to Section VII.

1. It is doubted whether the two-part form is helpful in the present case but nonetheless the amended claims have been cast in two-part form.
2. The incorporation by reference is believed to meet the relevant requirements and is considered helpful although the application is self-contained without this reference.
3. It is doubted whether this general principle applies appropriately to this specific case; if the Examiner has specific inclusion of reference numerals in mind he is invited to telephone the undersigned.

Section VIII.

1. We cannot accept that the presence of two independent claims, one to producing a decoded signal and one to re-coding the signal in this case renders the claims lacking in clarity or conciseness and objection under this general principle does not seem appropriate in this specific case.
- 2a. In the original claims it was specified that the signature information was representative of the decoded audio signal and reading this term in context would have made this clear. Nevertheless, the claims have been further clarified to define the signature information more clearly and to emphasise the distinction from D1.

We do not fully understand how the word "with" is intrinsically unclear and no amendment seems required.

- 2b. We believe that the reference to "detecting a change" is clear in ordinary English and one skilled in the art would readily be able to detect a change in an audio signal. The claim has been clarified in line with the other claims specifying that the signature information is "for use in" detecting a change. As the application as a whole makes clear, it is not critical where the signature information is provided and it may be provided with the auxiliary data signal or separately.
- 2c. These terms would be clear to one skilled in the art when read in context and no change is considered necessary. Nevertheless, the implicit meaning of the term "minor change" which is explicitly defined on page 4, lines 8-9 has been included in the claim.
- 2d. Again, the term "match" is a normal English term and one skilled in the art would appreciate what is meant by detecting a match between a signature of a signal and the signal. Nevertheless, it has been specified that the match is detected between the decoded audio signal and the signature information.
- 2e. It is submitted that this term would be perfectly clear when the claim is read as a whole, in particular when the term "the mean" is read in the context of the immediately following words the skilled person would immediately understand what is meant by "the mean decoded audio signal level". Nevertheless, to assist the Examiner, we have expanded the claim to specify that the decoded audio signal has a mean signal level and that the signature information includes a measure of this mean signal level.
- 2f. Although we doubt whether one skilled in the art would have difficulty with this term, we have nevertheless specified that the signature information signal contains signature information to avoid any possible problems.
- 2g. Although it is doubted that the skilled person would find lack of clarity, we have inserted the word "data" to avoid any perceived problem.
- 2h. Although it is believed that it would be clear to one skilled in the art that the auxiliary data signal and signature information are derived as part of the decoding process we have replaced the terms objected to by simply specifying that the signals are provided.
- 2j. Although basis is believed to be implicit in the reference to decoding, we have explicitly introduced reference to a decoded audio signal.
- 2k. The wording "signature information means for checking" was not present in the claims; the Examiner's scan of the claims apparently overlooked the semicolon at the end of the third line between "signature information" and "means for checking" which may clarify the meaning of the term. Nevertheless, this claim has been reworded as part of placing it in two-part form which should prevent any possible mis-reading.
- 2l. Although believed to be implicit, explicit agreement between the terms has been incorporated.
- 2m. Claim 17 did define the technical nature of the signals and there is no reason why such a claim should not be permitted. The claim has been further clarified to define the nature of the signature information.

British Broadcasting Corporation

25 September 2000

Should objections remain, in view of the fact that substantive examination has not been carried out yet and that there is plenty of time remaining in the International Preliminary Examining procedure a further, reasoned and substantive, Written Opinion is requested. As noted above, the representative would be happy to discuss any aspect of this application on the telephone if this will assist the procedure in any way.

Yours faithfully

Ilya Kazi
MATHYS & SQUIRE

/cvy

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

WRITTEN OPINION

(PCT Rule 66)

To:

KAZI, ILYA
MATHYS & SQUIRE
100 Gray's Inn Road
London WC1X 8AL
GRANDE BRETAGNE

28/9/00
Reply Written Opinion
by 28/9/00

Date of mailing
(day/month/year)

23.06.2000

Applicant's or agent's file reference

IK/20917

REPLY DUE

within 3 month(s)
from the above date of mailing

International application No.

PCT/GB99/03153

International filing date (day/month/year)

23/09/1999

Priority date (day/month/year)

23/09/1998

International Patent Classification (IPC) or both national classification and IPC

H04H7/00

Applicant

BRITISH BROADCASTING CORPORATION et al.

1. This written opinion is the first drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☐ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain document cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 23/01/2001.

Name and mailing address of the international preliminary examining authority:



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer / Examiner

Phillips, S A 9674

Formalities officer (incl. extension of time limits)

Teschauer, B
Telephone No. +49 89 2399 8231



I. Basis of the opinion

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*):

Description, pages:

1-8 as originally filed

Claims, No.:

1-17 as originally filed

Drawings, sheets:

1/1 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:**III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been and will not be examined in respect of:

- ☒ the entire international application,
☐ claims Nos. ,

because:

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

- ☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

see separate sheet

- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
- ☐ no international search report has been established for the said claims Nos. .

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Reference is made to the following documents:

D1: GB 2 321 577

Section III

1. Because of lack of clarity of the claims (see Section VIII below), no opinion can be established as to their novelty, inventive step or industrial applicability.

Section VII

1. Independent **claims 1, 9, 15 and 16** are not in the two part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art document D1 being placed in the preambles (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising parts (Rule 6.3(b)(ii) PCT).
2. In the description of the present application (page 1 line 7 and page 3 line 19), documents are "incorporated by reference". Since the application should be self contained (see Guidelines PCT/GL/3 II, 4.17), this phrase should not have been included.
3. The features/method steps of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Section VIII

1. The various definitions given in independent **claims 1 and 9** are such that the claims as a whole are not clear and concise, contrary to Article 6 PCT. The claims should include only the minimum necessary number of independent claims in any one category with dependent claims as appropriate, (Rule 6.4 PCT).

2. The following claims are unclear in the sense of Article 6 PCT for the reasons given below:
- (a) It is not clear what is meant by "signature information" (**claims 1, 9, 15 and 16**), and the use of this particular wording cannot distinguish the subject matter of claim 1 from the disclosure of D1 (see in particular D1 page 4 lines 29-32 and page 6 lines 8-16). Furthermore, the word "with" (**claim 1** line 2) is unclear and has been taken to mean "together with" for the purposes of the examination.
 - (b) The wording "for detecting a change" (**claim 1** line 5) is unclear since it does not specify what parameter of the decoded audio signal might change, to what reference the change is measured, nor how the "detection" is carried out. In addition, it is not clear how a signature information can "detect" a change, rather than represent the presence of one (if this is indeed the intended meaning; see the description page 1 line 25), nor where the signature information is provided.
 - (c) The words "minor" and "significant" (**claims 4 and 5**) are relative terms which render the subject matter of the claims vague and unclear.
 - (d) It is not clear as to what is meant by a "match" (**claim 5**), nor as to what quantity is compared with what other quantity. Corresponding objections apply to the subject matter of **claims 9 and 16**.
 - (e) It is not clear as to what quantity "the mean" (**claim 8**) refers.
 - (f) It is not clear whether "the signature information" (**claim 9** line 7) is intended to refer to "the signature information signal" (line 3) or "the received signature information" (line 4).
 - (g) It is not clear whether "the auxiliary data signal" (**claim 9** line 7) is

intended to refer to "the auxiliary signal" (line 2).

- (h) It is not clear (**claim 15** line 2) from where the auxiliary data signal is extracted or from where the signature information (line 4) is derived.
- (j) There is no antecedent basis for "the decoded signal" (**claim 15** line 4).
- (k) The wording "signature information means for checking" (**claim 16** lines 3-4) is unclear.
- (l) There is no antecedent basis for "the decoded audio information" (**claim 16** line 4).
- (m) The subject matter of **claim 17** is unclear since it refers to signals which might have been produced by any method/apparatus and does not define the technical nature of the signals. Such a claim should not be present in the application (see the Guidelines PCT/GL/3 III, 4.4).

In general, the claims do not clearly define the invention described in the specification on pages 1 and 2 and in drawing figure 1.

Further comments:

1. If filing amended claims the applicant should at the same time bring the description into conformity with the amended claims. Care should be taken during revision, especially of the introductory portion and any statements of problem or advantage, not to add subject-matter which extends beyond the content of the application as originally filed.

In order to facilitate the examination of the conformity of any amendments with the requirements of Article 34(2)(b) PCT, the applicant is requested to clearly identify the amendments carried out, irrespective of whether they concern amendments by addition, replacement or deletion, and to indicate

**WRITTEN OPINION
SEPARATE SHEET**

International application No. PCT/GB99/03153

the passages of the application as filed on which these amendments are based (see also Rule 66.8(a) PCT). Preferably these indications should be submitted in handwritten form on a copy of the relevant parts of the application as filed.



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PATENT COOPERATION TREATY

From the
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To:

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MATHYS & SQUIRE
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London WC1X 8AL
GRANDE BRETAGNE

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28 DEC 2000

REPLY DATE

DIARY ENTERED

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year)

22.12.2000

Applicant's or agent's file reference
IK/20917

IMPORTANT NOTIFICATION

International application No.
PCT/GB99/03153

International filing date (day/month/year)
23/09/1999

Priority date (day/month/year)
23/09/1998

Applicant
BRITISH BROADCASTING CORPORATION et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT


(PCT Article 36 and Rule 70)

Applicant's or agent's file reference IK/20917	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/03153	International filing date (day/month/year) 23/09/1999	Priority date (day/month/year) 23/09/1998
International Patent Classification (IPC) or national classification and IPC H04H7/00		
Applicant BRITISH BROADCASTING CORPORATION et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
 - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:
 - I ☒ Basis of the report
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☒ Certain defects in the international application
 - VIII ☐ Certain observations on the international application

Date of submission of the demand. 19/04/2000	Date of completion of this report 22.12.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Phillips, S Telephone No. +49 89 2399 8674



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB99/03153

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-8 as originally filed

Claims, No.:

1-16 with telefax of 25/09/2000

Drawings, sheets:

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☒ the claims, Nos.: 17

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/03153

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-16
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-16
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-16
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/03153

Reference is made to the following document:

D1: WO-A-98 33284

Section I

1. **Claim 1** is based on original claim 1 plus the description page 2 lines 12-14.

Claim 4 is based on original claim 5 plus the description page 2 lines 12-14.

Claim 8 is based on original claims 1 and 9 plus the description page 2 lines 12-14.

Claim 14 is based on original claims 1 and 15 plus the description page 2 lines 12-14.

Claim 15 is based on original claims 1 and 16 plus the description page 2 lines 12-14.

Claim 16 is based on original claims 1 and 17 plus the description page 2 lines 12-14.

Section V

1. The application relates to methods (**claims 1 and 8**), apparatus (**claims 14 and 15**) and signals (**claim 16**) for use in the decoding and re-encoding of compressed audio signals.
2. Document D1, which is cited on page 1 of the application, is regarded as being the closest prior art to the subject matter of **claims 1, 8, 14, 15 and 16** and discloses the provision of an auxiliary data signal comprising information for use in re-encoding a decoded audio signal,

from which the subject-matter of the present claims differs as follows;

to provide signature information representative of the decoded audio signal for use in detecting a change in the decoded audio signal, enabling significant changes in the audio signal to be detected but minor changes which are unlikely to substantially affect coding to be tolerated whilst making use of the information for use in re-encoding contained in the auxiliary data signal.

The subject-matter of **claims 1, 8, 14, 15 and 16** is therefore novel (Article 33(2) PCT).

3. Problem: How to avoid the situation that the auxiliary information becomes no longer helpful in the re-encoding process.
4. Solution: The feature linking **claims 1, 8, 14, 15 and 16** which is new with respect to the available prior art is to provide signature information representative of the decoded audio signal for use in detecting a change in the decoded audio signal, enabling significant changes in the audio signal to be detected but minor changes which are unlikely to substantially affect coding to be tolerated whilst making use of the information for use in re-encoding contained in the auxiliary data signal. Hence the particular solution is non-obvious and considered to be inventive (Article 33(3) PCT).
5. The dependent claims add further features to the independent claims and thus also relate to novel and inventive subject matter and hence meet the requirements of Article 33(2) and (3) PCT.

Section VII

1. The statement of the invention in the description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.
2. In the description of the present application (page 1 line 7 and page 3 line 19), documents are "incorporated by reference". Since the application should be self contained (see Guidelines PCT/GL/3 II, 4.17), this phrase should not have been included.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/03153

3. The features/method steps of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
4. There appears to be an error in the statement of dependency of claim 13, which appears as if it should have been dependent on claims 8-12 (Rule 6.4(a)) PCT).

CLAIMS

1. A method of audio signal processing comprising providing an auxiliary data signal for communicating with a decoded audio signal, the auxiliary data signal comprising information for use in re-encoding the decoded audio signal, the method being characterised by providing signature information representative of the decoded audio signal for use in detecting a change in the decoded audio signal, wherein the signature information contains information enabling significant changes in the audio signal to be detected but minor changes which are unlikely to affect coding substantially to be tolerated while making use of information for use in re-encoding contained in the auxiliary data signal.
2. A method according to Claim 1, wherein the signature information is included in the auxiliary data signal.
3. A method according to Claim 1 or 2, wherein the signature information includes a checksum calculated from decoded audio samples.
4. A method according to any preceding claim, wherein the signature information enables a match, or a partial match, between the decoded audio signal and the signature information to be detected when the decoded audio signal has undergone a minor change which is unlikely to affect coding substantially.
5. A method according to any preceding claim, wherein the signature information includes statistical information derived from the decoded audio signal.
6. A method according to any preceding claim, wherein the decoded audio signal has a mean signal level and the signature information includes a measure of said mean signal level.

7. A method according to any preceding claim, wherein the signature information includes a measure of standard deviation of sample values from the mean.
8. A method of re-encoding a decoded audio signal comprising receiving the decoded audio signal, an auxiliary data signal containing information for use in re-encoding the decoded audio signal and re-encoding the decoded audio signal based on re-encoding information contained in the auxiliary data signal, characterised by providing a signature information signal containing signature information representative of the decoded audio signal for use in detecting a change in the decoded audio signal, wherein the signature information contains information enabling significant changes in the audio signal to be detected but minor changes which are unlikely to affect coding substantially to be tolerated while making use of information for use in re-encoding contained in the auxiliary data signal; checking whether the received signature information matches the decoded audio signal; and wherein said re-encoding the decoded audio signal is based on re-encoding information contained in the auxiliary data signal if the signature information matches.
9. A method as claimed in Claim 8, wherein the signature information is combined with the auxiliary data signal.
10. A method according to Claim 8 or 9, wherein checking comprises deriving further signature information from the received audio signal and comparing the derived further signature information to the received signature information.
11. A method according to Claim 10, wherein comparing comprises comparing any difference between the derived and received signature information to at least one threshold.

12. A method according to any of Claims 8 to 10, wherein all of the auxiliary data signal is used for re-encoding if a perfect or near-perfect match is detected.
13. A method according to any of Claims 9 to 12, wherein some of the auxiliary data signal is used for re-encoding if a partial match is detected.
14. Apparatus for decoding a compression encoded audio signal comprising means for decoding the compression encoded audio signal to produce a decoded audio signal; and means for providing an auxiliary data signal containing information for use in re-encoding the decoded audio signal; characterised by
means for providing signature information representative of the decoded audio signal for use in detecting a change in the decoded audio signal, wherein the signature information contains information enabling significant changes in the audio signal to be detected but minor changes which are unlikely to affect coding substantially to be tolerated while making use of information for use in re-encoding contained in the auxiliary data signal.
15. Apparatus for re-encoding a decoded audio signal comprising:
means for receiving said decoded audio signal together with auxiliary information for use in re-encoding the signal; and
means for re-encoding the decoded audio signal based on the auxiliary information, characterised in that:
the means for receiving is arranged to receive signature information wherein the signature information contains information enabling significant changes in the audio signal to be detected but minor changes which are unlikely to affect coding substantially to be tolerated while making use of information for use in re-encoding contained in the auxiliary data signal, the apparatus further comprising means for checking whether the decoded audio signal matches the signature information; and wherein said means for re-encoding is arranged to re-encode the decoded audio signal based on the auxiliary

information if the decoded audio signal matches the signature information.

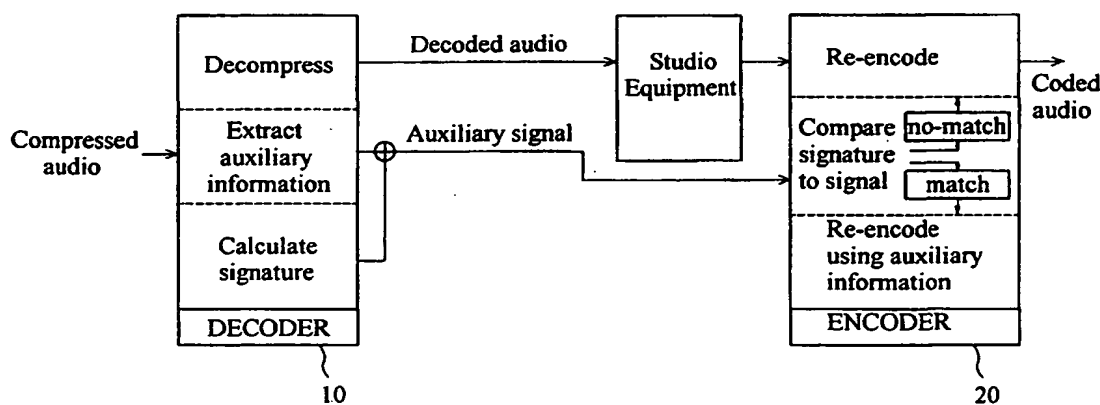
16. In combination, a decoded, previously compression encoded, audio signal, an auxiliary data signal comprising information for use in re-encoding the decoded audio signal, and a signature information signal containing signature information representative of the decoded audio signal for use in detecting changes in the decoded audio signal, wherein the signature information contains information enabling significant changes in the audio signal to be detected but minor changes which are unlikely to affect coding substantially to be tolerated while making use of information for use in re-encoding contained in the auxiliary data signal.



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H04H 7/00, H04B 1/66	A1	(11) International Publication Number: WO 00/18046 (43) International Publication Date: 30 March 2000 (30.03.00)
(21) International Application Number: PCT/GB99/03153 (22) International Filing Date: 23 September 1999 (23.09.99) (30) Priority Data: 9820757.4 23 September 1998 (23.09.98) GB (71) Applicant (for all designated States except US): BRITISH BROADCASTING CORPORATION [GB/GB]; Broadcasting House, London W1A 1AA (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): MASON, Andrew, James [GB/GB]; 1 Meadow Way, Reigate, Surrey RH2 8DP (GB). (74) Agents: KAZI, Ilya et al.; Mathys & Squire, 100 Gray's Inn Road, London WC1X 8AL (GB).		(81) Designated States: AU, CA, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: TANDEM AUDIO COMPRESSION



(57) Abstract

In a system in which an auxiliary data signal is conveyed with a decoded audio signal to assist in re-encoding, signature information is provided to assist in detecting changes in the decoded audio signal which would render the auxiliary data signal of little or no use in re-encoding. The signature information is most preferably included in the auxiliary data signal.

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TANDEM AUDIO COMPRESSION

The present invention relates to audio compression, and particularly to decoding and recoding of compressed audio signals.

5

Earlier British Broadcasting Corporation International Application WO-A-98/33284, the entire disclosure of which is incorporated herein by reference, discloses a method of decoding and recoding digital audio which results in reduced impairment in quality, by communicating an auxiliary signal containing information concerning coding decisions.

10

A problem can arise, however, that the decoded audio is processed so that the additional information no longer becomes helpful in the recoding process. Our earlier application suggests either disabling the auxiliary data signal in the event of such processing or adding a tell-tale signal to the decoded audio to indicate that such processing has occurred.

15

Whilst the above system works well, it has been found that an alternative arrangement may offer improved results in certain circumstances.

20

According to a first aspect, the invention provides a method of audio signal processing comprising providing an auxiliary data signal for communicating with a decoded audio signal, the auxiliary data signal comprising information for use in re-encoding the decoded audio signal, the method further comprising providing signature information representative of the decoded audio signal for use in detecting a change in the decoded audio signal.

25

In this way, rather than having to identify a tell-tale in the decoded audio, a change in the decoded audio can be automatically detected at the point of recoding by comparing the signature information to the decoded audio. Preferably, the signature information is communicated with the auxiliary data stream. Since the auxiliary

30

data stream must, in any event, be read in order to effect re-encoding based on the auxiliary data stream, this may simplify processing.

5 The signature information may include a checksum derived from the values of the decoded audio samples. This may enable identification of even very minor changes, and allow maintenance of absolute purity of the audio signal.

10 Alternatively, the signature information may include statistical information derived from the decoded audio signal, for example mean signal level and, optionally, standard deviation of sample values from the mean. This may enable significant changes in the audio signal to be detected, whilst rendering the system insensitive to minor modifications. Thus, the signature information may contain information enabling significant changes in the audio signal to be detected but minor changes to be ignored. Similarly, the signature information may enable a match, or a partial
15 match, to be detected when the decoded audio signal has undergone a minor change.

The method may further comprise detecting whether the signature information matches the decoded audio, for example by comparing a signature derived from the decoded audio signals to the communicated signature information and detecting
20 whether the difference between the derived and communicated signature exceeds a predetermined threshold. If the signature matches, then the decoded signals can be re-encoded using the auxiliary signal, for example in the manner described in our earlier application WO-A-98/33284. If the signature does not match, the decoded signal can be re-encoded without using the auxiliary data signal, or using only a part
25 of the auxiliary data signal.

The auxiliary signal may be derived together with the signature information from a received compression-encoded audio signal as part of compression decoding of the compression encoded audio signal.

30

The auxiliary data signal may be selected from the signals described in our earlier

application WO-A-98/33284.

Further aspects and preferred features are set out in the claims, to which reference should be made.

5

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which Fig. 1 is a schematic diagram of cascaded decoding and re-encoding processes according to a preferred embodiment.

10 Referring to Fig. 1, a compressed audio signal is passed to a decoder 10 which extracts auxiliary information for use in re-coding the signal and decompresses the signal to produce a decoded audio signal and an auxiliary signal. In the embodiment shown, the decoded audio signal and auxiliary signal are output separately. The decoded audio signal passes through studio equipment which may process the signal
15 and is re-encoded in an encoder 20. The auxiliary signal extracted is passed to the encoder 20 for use in re-encoding.

Thus far, the apparatus may be as described in our earlier WO-A-98/33284, the entire disclosure of which is incorporated herein by reference, with particular
20 reference to Fig. 2 and the related description.

In the embodiment shown, the auxiliary signal is communicated separately from the decoded audio signal. As an alternative, for example as described in WO-A-98/33284, the auxiliary signal may be communicated with the decoded audio signal;
25 one arrangement suitable for achieving this is described with reference to Fig. 3 of WO-A-98/33284.

In accordance with the present embodiment, in addition to auxiliary information for use in re-encoding, signature information representative of the decoded audio signal
30 is calculated by the decoder 10 and communicated as part of the auxiliary data signal.

The signature information may comprise, for example, a checksum calculated for individual audio samples or for a predetermined number of audio samples. The provision of a checksum enables accurate verification of faithful reproduction of the audio signal. Alternatively, the signature information may comprise a measure
5 derived from the decoded audio signal, for example a statistical measure such as the mean signal level, and optionally the standard deviation (or other measure, such as variance or the like) of samples from the mean. Provision of statistical or other information may enable minor changes (by which is meant changes which are unlikely to affect coding substantially) to be tolerated while making use of previous
10 coding information. Provision may be made for identifying a partial match based on closeness of match so that some or all information may be used.

The auxiliary signal and the signature signal are preferably conveyed together as a single digital data signal. They can advantageously be conveyed in the user bits of
15 an AES-3 bitstream.

In the encoder 20, the signature information received is compared to a further signature calculated from the decoded audio signal which has been processed by the studio equipment. If the signatures match within a predetermined threshold, re-encoding is performed using the auxiliary information, for example in the manner
20 described in WO-A-98/33284.

If the signatures do not match, re-encoding is performed without reference to the auxiliary signal.
25

The setting of the threshold within which a match is detected will depend on the nature of the auxiliary signal and also the nature of the signature information. The threshold should be set so that the auxiliary information is used whenever it might assist the re-coding process but discarded when it will not improve the fidelity of
30 the overall cascaded decoding and re-encoding processes.

In certain cases, rather than a "yes/no" comparison, the re-encoding process may be arranged to take some, but not all, of the auxiliary information into account or to modify a "blind" re-encoding process based on the auxiliary information when an imperfect signature match is detected, but not to discard the auxiliary information entirely.

By way of background, we will summarise certain examples of auxiliary information and ways in which it may be carried (as described in WO-A-98/33284).

Examples of signals that could comprise the auxiliary data are:

1. The coded audio signal at the input to the decoder (D1, D2, etc.). This contains not only audio-related data and the PTS but also certain auxiliary information such as programme-associated data (PAD), which may need to be copied into the coded signal at the output from the studio area, and error protection. Depending upon the circumstances, such a signal would enable the coder (C) to substitute the original coded signal for the re-coded PCM signal, or to re-code the PCM signal with blocks of audio data resembling closely the blocks within the original coded signal, as described above. Conveying the coded audio signal to the coder provides the widest range of options for re-coding with minimal additional impairment of the audio.

2. The coded audio samples at the input to the decoder minus the quantised audio samples (which can be re-created identically from the PCM audio signal). This is a signal in which the positions of the frame boundaries of the original coded signal are indicated relative to the linear audio samples in the PCM signal, and from which the positions of the blocks of data within the frames may be deduced, together with information on the allocation of bits to the various components of the coded signal (sometimes known as "bit-allocation data"), scale factors, block lengths (in coding schemes where, this

is relevant), the PTS, and any other data relevant to the coding system in use.

- 5 3. A signal similar to that described in "2" above, but containing a subset of the information described (e.g. just the positions of the frame boundaries).

10 As mentioned above, the signature information is preferably carried with the auxiliary data. It may however be carried independently, for example along a dedicated channel.

15 The following are ways in which the auxiliary data signal might be transported with the PCM audio. The signature information, if not combined with the auxiliary data signal, may be transported along another of these (or other) possible routes. The routes are:-

- 20 1. In the auxiliary sample bits of the ITU-R Rec. 647 bitstream. At the studio standard sampling frequency of 48 kHz, a total bit rate of 384 kbit/s is available in the auxiliary sample bits of both "X" and "Y" subframes. This method is ideal for conveying the auxiliary data between different items of equipment but there is some uncertainty concerning the way in which studio equipment might treat these auxiliary sample bits. For example, the studio equipment may not route these bits through to the output with the PCM audio, or it may not delay these bits by the same amount as the PCM audio. In either case, some modification of the studio equipment, or of the environment around it, may be necessary.

- 30 2. In the least significant bits (l.s.b.) of the PCM audio sample words of the ITU-R Rec. 647 bitstream. The bits can be inserted into active audio or may be additional bits. Depending upon the resolution of the studio equipment these may be the same as the auxiliary sample bits (these are the

l.s.b if the Rec. 647 signal is configured to carry 24-bit audio sample words) or the least significant bits within the part of the subframe reserved for 20-bit audio sample words (these are the same bits that carry the 20 most significant bits of 24-bit sample words). The data can be carried as the least significant bit of 16 bit audio. Carrying the auxiliary data in the l.s.b. of the audio sample words overcomes the problems of routing within the studio equipment and care will be taken to ensure that the auxiliary data signal is inaudible. The studio equipment needs to be transparent to audio sample words of at least 20 bits. If necessary, the audibility of the auxiliary data signal could be reduced by scrambling (e.g. by the modulo-2 addition of a pseudorandom binary sequence, or the use of a self-synchronising scrambler). Alternatively, it could be removed altogether by truncating the audio sample words to the appropriate length (i.e. to exclude the auxiliary data).

3. In the user data bits of the ITU-R Rec. 647 bitstream. Taking the user data bits from both "X" and "Y" subframes provides a channel with a bit rate of only 96 kbit/s. In many applications this is unlikely to be sufficient to carry the complete coded audio signal. It would be sufficient to signal the positions of frame boundaries, and to carry some other information extracted from the coded audio. With this method there is uncertainty concerning the way in which studio equipment might treat the user data.

4. In the upper part of the audio spectrum, at frequencies higher than those of the audible components of the signal. For this purpose, the PCM audio signal would be low-pass filtered, and the coded auxiliary data signal added above the passband occupied by the audible signal. A particularly ingenious way of doing this, when the studio area is receiving MPEG audio coded signals, would be to use an MPEG analysis subband filterbank with the reciprocal synthesis filterbank at the insertion units. At 48 kHz sampling

frequency, the audio passband extends almost up to 24 kHz. In MPEG audio coding this passband is divided into 32 equally-spaced subbands, each with a bandwidth of 750 Hz. The upper five subbands are not used, and the audio is thus effectively low-pass filtered to 20.25 KHz. The auxiliary data could be inserted into the upper subbands, and would be carried in the upper part of the spectrum of the PCM audio signal, to be extracted by another MPEG analysis filterbank at the splitter. The PCM signal applied to the coder would not need further filtering to remove the auxiliary data, as this would happen in the analysis filterbank in the coder itself.

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10
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5. The auxiliary signal might be a low-level known pseudo random binary sequence (prbs) added to the audio. The prbs would be synchronised in some way with the audio frame boundaries and may be modulated with additional data where possible. It is also possible to subtract the prbs from the data prior to final transmission or monitoring.

20
It has been explained that under certain circumstances it is appropriate to perform partial decoding and re-encoding. In the appended claims the terms decoding and re-encoding should be taken as including partial decoding and re-encoding, respectively.

25
It will be appreciated that there are numerous ways in which the invention can be applied to assist in re-encoding of a previously decoded signal. In particular, it is to be noted that the present invention is not specifically limited to a basic decoding and recoding process as described in WO-A-98/33284, the disclosure of which is provided purely by way of an exemplary system in which the invention may be employed.

30
Each feature disclosed herein may be provided independently, unless otherwise stated.

CLAIMS

1. A method of audio signal processing comprising providing an auxiliary data signal for communicating with a decoded audio signal, the auxiliary data signal comprising information for use in re-encoding the decoded audio signal, the method further comprising providing signature information representative of the decoded audio signal for detecting a change in the decoded audio signal.
2. A method according to Claim 1, wherein the signature information is included in the auxiliary data signal.
3. A method according to Claim 1 or 2, wherein the signature information includes a checksum calculated from decoded audio samples.
4. A method according to any preceding claim, wherein the signature information contains information enabling significant changes in the audio signal to be detected but minor changes to be ignored.
5. A method according to any preceding claim, wherein the signature information enables a match, or a partial match, to be detected when the decoded audio signal has undergone a minor change.
6. A method according to any preceding claim, wherein the signature information includes statistical information derived from the decoded audio signal.
7. A method according to any preceding claim, wherein the signature information includes a measure of the mean decoded audio signal level.
8. A method according to any preceding claim, wherein the signature

information includes a measure of standard deviation of sample values from the mean.

- 5 9. A method of re-encoding a decoded audio signal comprising receiving the decoded audio signal, an auxiliary signal containing information for use in re-encoding the decoded audio signal and a signature information signal; checking whether the received signature information matches the decoded audio signal; and
- 10 re-encoding the decoded audio signal based on re-encoding information contained in the auxiliary data signal if the signature information matches.
10. A method as claimed in Claim 9, wherein the signature information is combined with the auxiliary data signal.
- 15 11. A method according to Claim 9 or 10, wherein checking comprises deriving further signature information from the received audio signal and comparing the derived further signature information to the received signature information.
- 20 12. A method according to Claim 11, wherein comparing comprises comparing any difference between the derived and received signature information to at least one threshold.
- 25 13. A method according to any of Claims 9 to 11, wherein all of the auxiliary data signal is used for re-encoding if a perfect or near-perfect match is detected.
14. A method according to any of Claims 9 to 13, wherein some of the auxiliary data signal is used for re-encoding if a partial match is detected.
- 30 15. Apparatus for decoding a compression encoded audio signal comprising

means for decoding the signal; means for extracting an auxiliary data signal containing information for use in re-encoding the signal; and
means for deriving signature information representative of the decoded signal for use in detecting a change in the decoded signal.

5

16. Apparatus for re-encoding a decoded audio signal comprising:
means for receiving said decoded audio signal together with auxiliary
information for use in re-encoding the signal and signature information;
means for checking whether the decoded audio information matches the
signature information; and means for re-encoding the decoded signal based
on the auxiliary information if the signature matches.
17. In combination, a decoded previously compression encoded audio signal, an
auxiliary data signal comprising information for use in re-encoding the
decoded audio signal, and a signature information signal representative of the
decoded audio signal for use in detecting changes in the decoded audio
signal.

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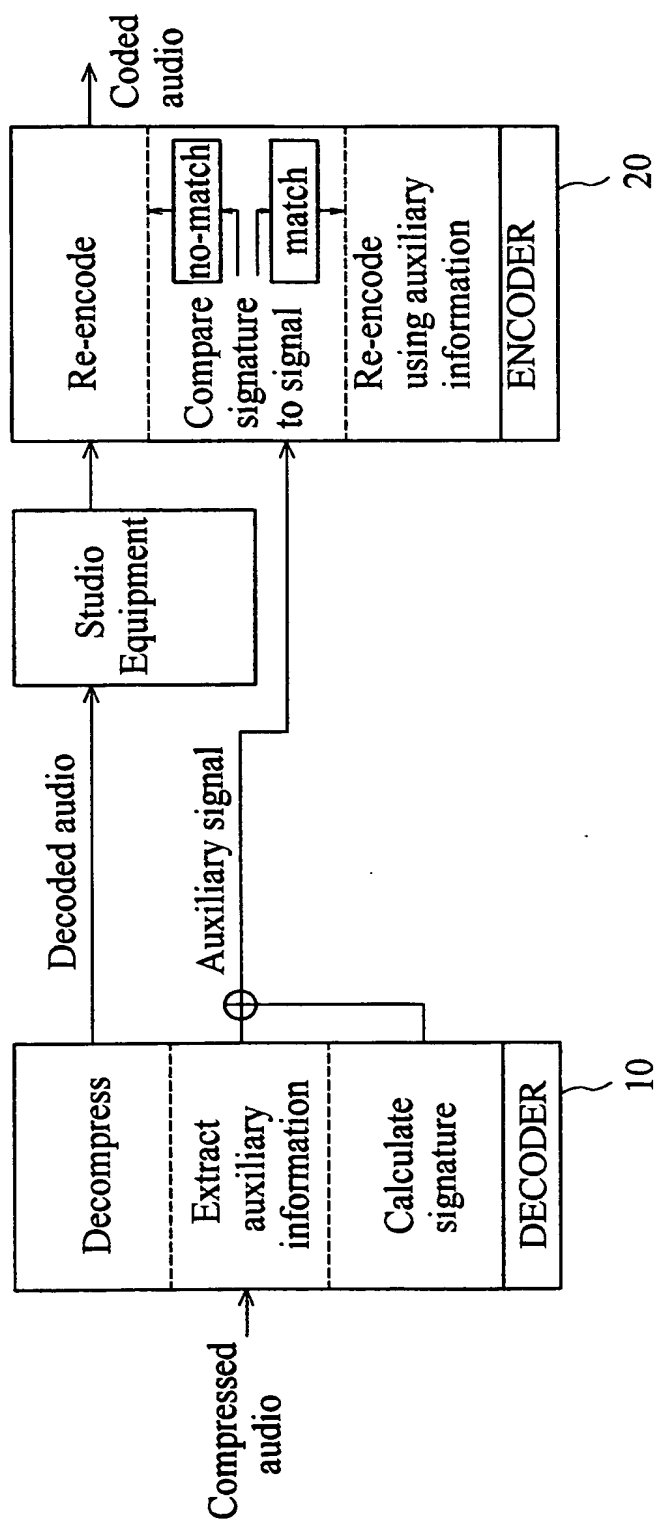


Fig. 1

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/03153

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H04H7/00 H04B1/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04H H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 321 577 A (BRITISH BROADCASTING CORP) 29 July 1998 (1998-07-29) cited in the application abstract page 1, line 23 - line 30 page 2, line 10 - line 22; figure 1 page 4, line 29 - line 32 page 6, line 8 - line 18 -----	1,4,17

☐

Further documents are listed in the continuation of box C.

☒

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/GB 99/03153

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		EP 0958664 A	24-11-1999
		WO 9833284 A	30-07-1998
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(52) UK CL (Edition P)
H4P PDCFX
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(56) Documents Cited
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Online : WPI

(54) Abstract Title
Compression decoding and re-encoding

(57) An auxiliary data signal is derived from a received compression encoded audio signal during decoding of the signal and communicated with the decoded audio signal for use in re-encoding the signal. The auxiliary data signal may be communicated integrally with the audio signal, for example in the least significant bits, or may follow a different path. The provision of the auxiliary data signal may enable more transparent decoding and re-coding processes to take place, by allowing the coding decisions to match the coding decisions originally used; this can alleviate problems with quality reduction arising from cascaded decoding and re-coding processes.

Application is to digital broadcasting in the studio environment with mixing, fading, etc.

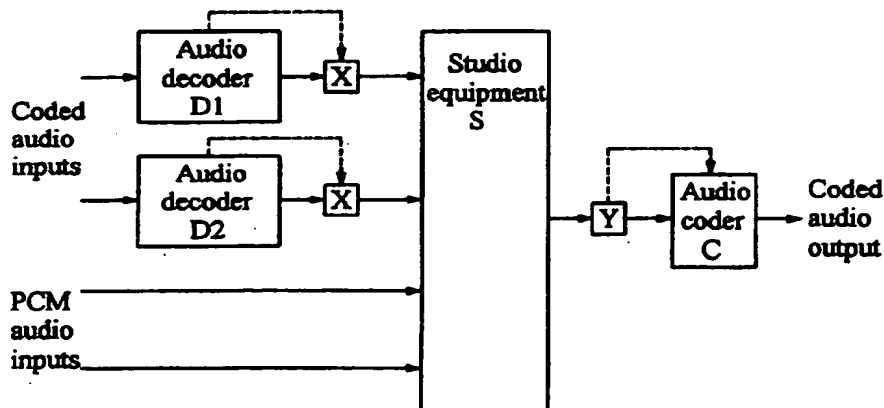
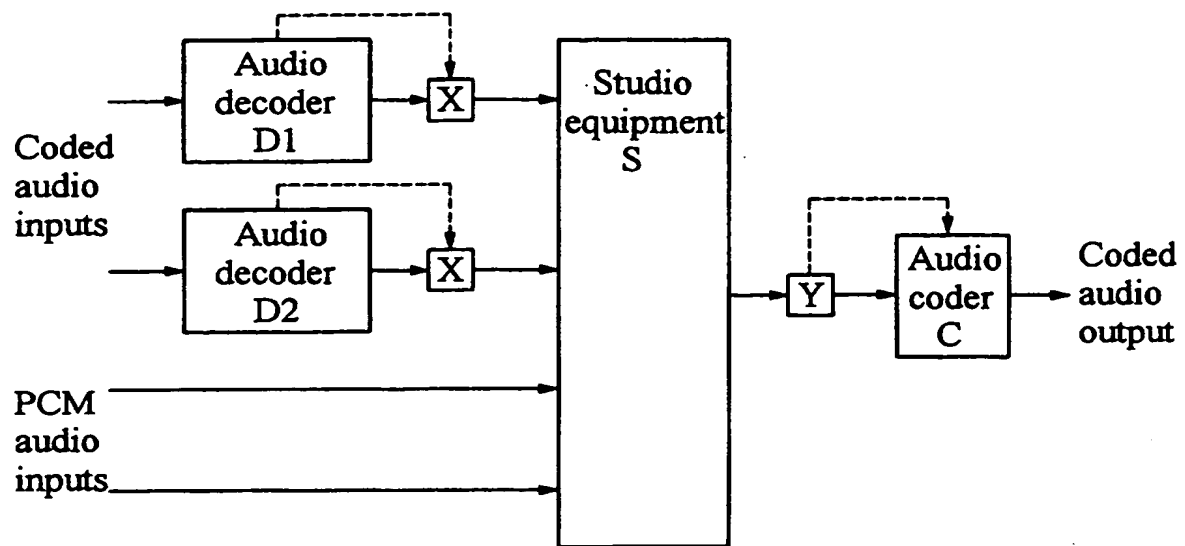
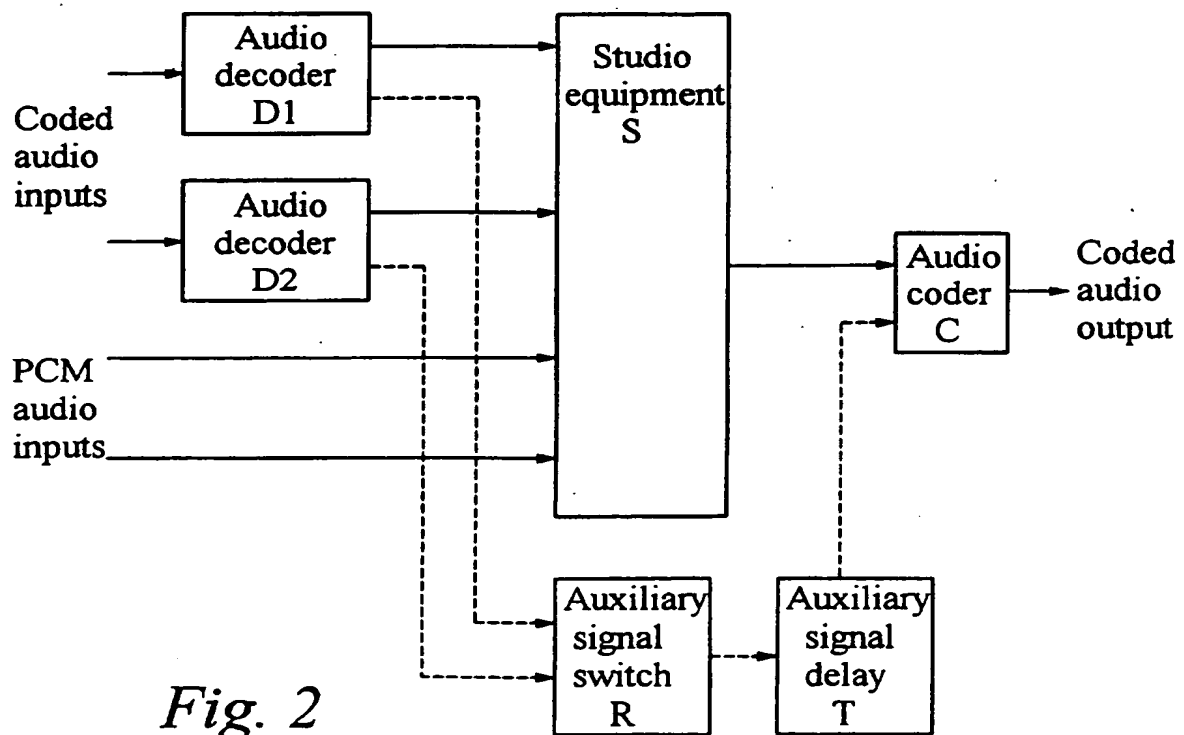


Fig. 1

*Fig. 1**Fig. 2*

AUDIO COMPRESSION

This invention relates to compressed, that is to say data-reduced or bit-rate reduced, digital audio signals.

The invention is applicable to a wide range of digital audio compression techniques; an important example is the so-called "MPEG Audio" coding, defined in ISO/IEC standards IS 11172-3 and IS 13818-3.

In digital broadcasting, certain operations can be performed only on decoded audio signals. There is accordingly a requirement for compression decoding and re-encoding in the studio environment. It is of course desirable that these cascaded decoding and re-encoding processes should involve minimal reduction in quality. Studio operations such as mixing may be conducted on a digital PCM signal, although sometimes there will be a requirement for conversion of the PCM signal to analogue form. In the discussions that follow, attention will be focused on the use of a decoded audio signal in PCM format although it should be remembered that the invention also encompasses the use of decoded analogue signals in analogue form. It will further be appreciated that whilst the digital broadcasting studio environment conveniently exemplifies the present invention, the invention is applicable to other uses of compressed audio signals.

It is an object of the present invention, in one aspect, to provide improved digital audio signal processing which enables re-encoding of a compression decoded audio signal with minimal reduction in quality

Accordingly, the present invention consists in one aspect in a method of audio signal processing, comprising the steps of receiving a compression encoded audio signal; compression decoding the encoded audio signal; deriving an auxiliary data signal; communicating the auxiliary data signal with the decoded audio signal and re-encoding the decoded audio signal utilising information from the auxiliary data signal.

Preferably, the auxiliary data signal comprises essentially the encoded audio signal.

In one form of the invention, the auxiliary data signal is combined with the decoded audio signal for communication along the same signal path as the decoded audio signal.

5 The invention will now be described by way of example with reference to the accompanying drawings in which:-

Fig. 1 is a block diagram of a digital broadcasting studio installation utilising an embodiment of the present invention; and

Fig. 2 is a block diagram of similar form illustrating a second embodiment of the present invention.

10 Referring to Fig. 1, a coded audio bit-stream enters the decoder (D1) at the top left and the decoder produces a linear PCM audio signal, typically in the form of an ITU-R Rec. 647 ("AES/EBU") bitstream, although other forms of PCM signal may be used. The PCM signal is connected to the studio equipment (S) which may provide such facilities as fading, mixing or
15 switching. This connection is made via an insertion unit (X) which combines the auxiliary data signal with the PCM audio signal. Other audio sources are connected to the studio equipment; these are in the form of PCM signals, but some or all of them may previously have been coded, and those decoded locally may be accompanied by auxiliary data signals (e.g. the
20 PCM signal from Decoder D2). The output of the studio equipment is applied to the input of the coder (C) via a signal splitter unit (Y) which separates the auxiliary data from the PCM signal. The output of the coder is a coded (i.e. digitally compressed) audio signal. In Fig. 1, the PCM signal path is represented by the solid line connecting the decoder and coder via
25 the studio equipment. If just a PCM signal arrives at the coder (i.e. the auxiliary data signal is not present) the latter has to perform an independent re-coding process. This introduces impairments in the form of coding artifacts into the signal (in the case of a PCM signal which has previously been coded, but without the auxiliary signal, these artifacts are additional to
30 those present as the result of the earlier coding).

In the example of an MPEG audio signal, the most important

information to carry with the signal is the positions of the coded audio frame boundaries. These frames are 24ms long when the sampling frequency is 48 kHz.

5 The build up of impairments can be completely eliminated by avoiding decoding and re-coding wherever possible. For example, if enough of the original coded audio signal is conveyed to the coder, as the auxiliary data signal, the coded audio signal can be reconstituted and substituted for the decoded and re-coded signal. This would require that the studio equipment pass the PCM signal transparently, and that the coded bitstreams to be
10 switched or mixed are frame aligned, or can be brought into frame alignment. Frame aligning can give rise to problems with audio/visual synchronisation ("lip sync") in applications such as television where video is associated with the audio.

15 Alternatively, if the auxiliary data signal indicates to the coder the positions in the PCM bitstream of the frame boundaries of the original coded signal, it is possible to minimise any impairment introduced on re-coding if the original groups of audio samples which formed blocks of coded data (e.g. subband filter blocks or blocks of samples with the same scalefactor) are kept together to form equivalent blocks in the re-coded signal. This
20 does not require frame alignment of coded bitstreams within the studio area, but it does require alignment of the appropriate data blocks within the bitstreams. Such alignment can be effected by the introduction of relatively short delays, which do not significantly affect audio/video synchronisation. Further reductions in the impairment on re-coding may be made if
25 information on the quantisation of the audio in the coded bitstream is conveyed to the coder (C).

30 A further possibility is to move frame boundaries in the incoming coded bitstreams, whilst preserving the original blocks of coded data, to bring the frames closer to alignment. Relatively short delays can then be used to effect frame alignment by "fine tuning" the timing of the signals. Frame aligning the coded bitstreams in this way, at a point where the entire incoming coded audio signal is available will minimize further impairment of

the audio, and re-coding will take place with the repositioned frame boundaries.

5 If the frame boundaries are repositioned in such a way as to preserve the original block of samples with the same scale factor, only a partial decoding operation is needed. This technique is particularly suited to the editing of bit-rate reduced digital signals because full decoding and re-encoding can be eliminated.

10 In the case where the studio is receiving MPEG audio coded signals in the form of packetised elementary streams (PES), buffer stores in the decoders are used to ensure that the audio signals are correctly timed to a local clock and (if appropriate) to associated video signals, using a programme clock reference (PCR) and presentation time stamps (PTS) within signals. The relatively small adjustments to signal timing needed to align blocks within coded bitstreams entering the studio with the blocks
15 formed by the re-encoding process in the coder (C) may be made either by making some adjustment to the timing in the decoders (D1, D2 etc.) or by introducing delays into the PCM signal paths.

20 In the arrangement of Fig. 1, the auxiliary data takes the same path as the PCM signal through the studio equipment, and is combined with the PCM audio in such a way that it has the minimal effect upon the audio. It is routed with the audio, and if the path is not transparent (e.g. because of fading or mixing) the modification of the auxiliary signal is detected in the coder, and re-coding of the audio proceeds independently of the auxiliary signal. If the path is transparent, the unmodified auxiliary signal facilitates
25 the substitution of the re-coded PCM signal by the original coded signal, or re-coding with the data blocks of the re-coded signal reproducing the blocks of the original signal as closely as possible, as described above. The dotted line of Fig. 1. represents the path taken by the auxiliary data.

30 Any modification of the signal and associated auxiliary data is detected by appropriate examination of the auxiliary data. For example, the auxiliary data may be accompanied by error-detecting cyclic redundancy check bits associated with the auxiliary data for each coded audio frame.

Audio signals which have not previously been coded will not be accompanied by any auxiliary data and will be impaired by the coding artifacts introduced by first-time coding when coded by the coder (C). Signals which have previously been coded but for which no auxiliary data is available will be impaired by additional coding artifacts when re-coded by the coder (C).

Referring to Fig. 2, the PCM audio signal takes the same path through the studio equipment from the decoder (D1) to the coder (C) via the studio equipment (S). However, in this arrangement, the auxiliary data signal is not combined with the PCM audio but is routed separately. This arrangement has the advantage that the auxiliary data is not combined with the PCM audio, and there is no risk of audible changes to the signal as a result. This might be important, for example, if the studio equipment has only a limited resolution in terms of the audio sample word-length.

Furthermore, the auxiliary data is not modified by fading or mixing. There are disadvantages in that the auxiliary signal needs to be delayed to keep it time-aligned with the PCM audio passing through the studio equipment (S), and switching is necessary in the auxiliary data path so that the correct auxiliary data is always presented to the coder (C) with the associated PCM signal. As in the arrangement of Fig. 1, the coder needs to perform re-coding independently of the auxiliary signal at times when the path through the studio equipment (S) is not transparent. One way of ensuring that this happens is for the switch (R) which routes the auxiliary signals the coder to suppress all such signals when independent re-coding is necessary.

Another way would be to add a subsidiary auxiliary data signal to the audio passing through the studio equipment (S) which would enable detection of non-transparent processing. This might be, for example, a known pseudorandom binary sequence (prbs) or some form of cyclic redundancy check data on some or all of the audio data.

In Fig. 2, the delay (T) required in the auxiliary data path should be constant, and may be determined by means of suitable tests. However, incoming MPEG audio coded bitstreams in PES form contain PTS, as

mentioned previously, and PCM audio signals can carry time information (e.g. the time codes in the ITU-R Rec. 647 signal) which may comprise, or be derived from, the incoming PTS. If the auxiliary signal contains the same information, or the PTS itself, the initial setting of the delay (T) and the subsequent verification of the amount of delay may be performed automatically.

Examples of signals that could comprise the auxiliary data are:

1. The coded audio signal at the input to the decoder (D1, D2, etc.). This contains not only audio-related data and the PTS but also certain auxiliary information such as programme-associated data (PAD), which may need to be copied into the coded signal at the output from the studio area, and error protection. Depending upon the circumstances, such a signal would enable the coder (C) to substitute the original coded signal for the re-coded PCM signal, or to re-code the PCM signal with blocks of audio data resembling closely the blocks within the original coded signal, as described above. Conveying the coded audio signal to the coder provides the widest range of options for re-coding with minimal additional impairment of the audio.
2. The coded audio samples at the input to the decoder minus the quantised audio samples (which can be re-created identically from the PCM audio signal). This is a signal in which the positions of the frame boundaries of the original coded signal are indicated relative to the linear audio samples in the PCM signal, and from which the positions of the blocks of data within the frames may be deduced, together with information on the allocation of bits to the various components of the coded signal (sometimes known as "bit-allocation data"), scale factors, block lengths (in coding schemes where, this is relevant), the PTS, and any other data relevant to the coding system in use.

3. A signal similar to that described in "2" above, but containing a subset of the information described (e.g. just the positions of the frame boundaries).

5 Ways in which the auxiliary data signal might be transported with the PCM audio are:

- 10 1. In the auxiliary sample bits of the ITU-R Rec. 647 bitstream. At the studio standard sampling frequency of 48 kHz, a total bit rate of 384 kbit/s is available in the auxiliary sample bits of both "X" and "Y" subframes. This method is ideal for conveying the auxiliary data between different items of equipment but there is some uncertainty concerning the way in which studio equipment might treat these auxiliary sample bits. For example, the studio equipment may not route these bits through to the output with the PCM audio, or it may not delay these bits by the same amount as the PCM audio. In either case, some modification of the studio equipment, or of the environment around it, may be necessary.
- 20 2. In the least significant bits (l.s.b.) of the PCM audio sample words of the ITU-R Rec. 647 bitstream. Depending upon the resolution of the studio equipment these may be the same as the auxiliary sample bits (these are the l.s.b. if the Rec. 647 signal is configured to carry 24-bit audio sample words) or the least significant bits within the part of the subframe reserved for 20-bit audio sample words (these are the same bits that carry the 20 most significant bits of 24-bit sample words). Carrying the auxiliary data in the l.s.b. of the audio sample words overcomes the problems of routing within the studio equipment and care will be taken to ensure that the auxiliary data signal is inaudible. The studio equipment needs to be transparent to audio sample words of at least 20 bits. If necessary, the audibility of the auxiliary data signal could be reduced by scrambling (e.g. by the

modulo-2 addition of a pseudorandom binary sequence, or the use of a self-synchronising scrambler). Alternatively, it could be removed altogether by truncating the audio sample words to the appropriate length (i.e. to exclude the auxiliary data).

- 5 3. In the user data bits of the ITU-R Rec. 647 bitstream. Taking the user data bits from both "X" and "Y" subframes provides a channel with a bit rate of only 96 kbit/s. In many applications this is unlikely to be sufficient to carry the complete coded audio signal. It would be sufficient to signal the positions of frame boundaries, and to carry some other information extracted from the coded audio. With this method there is uncertainty concerning the way in which studio equipment might treat the user data.
- 10
- 15 4. In the upper part of the audio spectrum, at frequencies higher than those of the audible components of the signal. For this purpose, the PCM audio signal would be low-pass filtered, and the coded auxiliary data signal added above the passband occupied by the audible signal. A particularly ingenious way of doing this, when the studio area is receiving MPEG audio coded signals, would be to use an MPEG analysis subband filterbank with the reciprocal synthesis
- 20 filterbank at the insertion units (X) in Fig. 1. At 48 kHz sampling frequency, the audio passband extends almost up to 24 kHz. In MPEG audio coding this passband is divided into 32 equally-spaced subbands, each with a bandwidth of 750 Hz. The upper five subbands are not used, and the audio is thus effectively low-pass
- 25 filtered to 20.25 KHz. The auxiliary data could be inserted into the upper subbands, and would be carried in the upper part of the spectrum of the PCM audio signal, to be extracted by another MPEG analysis filterbank at the splitter (Y) shown in Fig. 1. The PCM signal applied to the coder (C) would not need further filtering to remove the
- 30 auxiliary data, as this would happen in the analysis filterbank in the

coder itself.

- 5 5. The auxiliary signal might be a low-level known pseudo random binary sequence (prbs) added to the audio. The prbs would be synchronised in some way with the audio frame boundaries and may be modulated with additional data where possible. It is also possible to subtract the prbs from the data prior to final transmission or monitoring.

10 It has been explained that under certain circumstances it is appropriate to perform partial decoding and re-encoding. In the appended claims, the terms decoding and re-encoding should be taken as including partial decoding and re-encoding, respectively.


CLAIMS

1. A method of audio signal processing, comprising the steps of receiving a compression encoded audio signal; compression decoding the encoded audio signal; deriving an auxiliary data signal; communicating the
5 auxiliary data signal with the decoded audio signal and re-encoding the decoded audio signal utilising information from the auxiliary data signal.
2. A method according to Claim 1, wherein the auxiliary data signal comprises essentially the encoded audio signal.
3. A method according to Claim 1, wherein the auxiliary data signal
10 comprises audio-related data from the encoded audio signal.
4. A method according to Claim 3, wherein the auxiliary data signal comprises time information from the encoded audio signal.
5. A method according to Claim 4, wherein the auxiliary data signal further comprises ancillary information, such as programme-associated data,
15 from the encoded audio signal.
6. A method of audio signal processing, comprising the steps of receiving a compression encoded audio signal; compression decoding the encoded audio signal; deriving an auxiliary data signal indicative of the analysis and quantisation employed for the encoded audio signal;
20 communicating the auxiliary data signal with the decoded audio signal and re-encoding the decoded audio signal utilising information from the auxiliary data signal such that the re-encoded audio signal employs the same analysis and quantisation as the encoded audio signal.
7. A method according to Claim 6, wherein the analysis comprises
25 application of sub-band filter bank.

8. A method according to Claim 7, wherein the auxiliary data signal is indicative of the analysis into sub-bands and the quantisation within each sub-band employed for the encoded audio signal.

5 9. A method according to any one of the preceding claims, wherein the encoded audio signal is an MPEG audio coded signal.

10. A method according to Claim 9, wherein the auxiliary data signal contains information relating to one or more of: the position of audio frame boundaries in the audio signal; scale factors for the blocks of sub-band samples within each audio frame; bit allocation data for the audio frame



10

11. A method according to any one of the preceding claims, wherein the auxiliary data signal is combined with the decoded audio signal for communication along the same signal path as the decoded audio signal.

15 12. A method according to Claim 11, wherein the auxiliary data signal is formatted to enable an integrity check prior to use of the auxiliary data signal in a re-encoding process, to ensure transparent communication of the auxiliary data signal along the decoded audio signal path.

13. A method according to Claim 11, wherein the auxiliary data signal is carried in the least significant bits of a digital decoded audio signal.

20 14. A method according to Claim 11, wherein the auxiliary data signal is carried as user data bits in a recognized digital interface format such as ITU-R Rec. 647.

16. A method according to Claim 15, wherein the auxiliary data signal is carried in higher frequencies associated with sub-bands unused in the compression encoding.

5 17. A method according to Claim 16, in which MPEG audio coding is employed, wherein a filter arrangement analogous to the MPEG analysis sub-band filter arrangement and its reciprocal, is employed for insertion of the auxiliary data signal into the decoded audio signal.

10 18. A method according to any one of Claims 1 to 10, wherein the auxiliary data signal is carried in a separate path to the decoded audio signal.

19. A method according to Claim 18, wherein the auxiliary data signal path is disabled in the event of processing in the decoded audio signal preventing sensible use of information from the auxiliary data signal in re-encoding.

15 20. A method according to Claim 19, wherein a tell-tale is added to the decoded audio signal to indicate such processing.



The Patent Office

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Claims searched: 1-20

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Int Cl (Ed.6): H03M 7/30; H04B 1/66; H04H 7/00; H04N 5/60, 7/52

Other: online WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0640909 A1 Texas Instruments Inc. - see columns 1-3 and column 12, lines 33-49 (and equivalent US 5568495)	
A	US 5185800 Centre National D'Etudes des Telecom. - see column 9, lines 33-37 (and equivalent EP 0423050 A1)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.